Masconomet Regional High School Curriculum Guide

Course Title: Honors Chemistry Course Number: 3231

Department: Science Grade Level and Phase: 10th and 11th grade

Length of Course: one year

Course Description:

This is a rigorous course for high achieving students in their sophomore year. The course provides a more advanced treatment of the topics taught in Chemistry CP, and each student will complete an independent research project. Students will be prepared to take the MCAS Chemistry exam in June. Prerequisite: Completion, or concurrent enrollment in Algebra II (H) and completion of Biology (H) with a grade of C+ or better or completion of Biology (CP) with a grade of A- or better.

Objectives:
The course is designed to develop critical thinking skills, independent laboratory skills, quantitative and qualitative problem solving skills, and self-discipline in using an advanced high school chemistry text as a learning tool. Students who complete the course are expected to have the knowledge, critical thinking ability, and laboratory expertise to enable the student to successfully compete in a first year course in college chemistry. Successful completion of the course requires that each student completes thirty-five wet chemistry laboratory experiments, seventeen problem sets based on the chapters covered in the textbook, and sixteen chapter exams. The course requires and employs a solid understanding of algebra II and includes higher-level quantitative problems designed to foster critical thinking skills and analytical reasoning. The course includes many guided inquiry activities, and laboratory work is an essential and integral part of this course. Students are expected to exit this course having gained a firm understanding of the concepts of chemistry, well developed skills in designing and carrying out laboratory activities, and critical thinking skills. The level of independent student work in this course is also higher than the typical college preparatory level chemistry course. Students are required to read and learn independently of classroom instruction, design and refine laboratory experiments, and research current topics in chemistry. Students are also expected to do independent research in the form of a science fair project and participate in the Masconomet Regional High School Science Fair.

Content and skill objectives for Honors Chemistry are designed to meet the learning expectations described in the Massachusetts Curriculum Framework for Chemistry:

1. Properties of Matter

Broad Concept: Physical and chemical properties reflect the nature of the interactions between molecules or atoms and can be used to classify and describe matter.

1.1 Identify and explain physical properties (such as density, melting point, boiling point, conductivity, and malleability) and chemical properties (such as the ability to form new substances). Distinguish between chemical and physical changes.

1.2 Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures.

1.3 Describe the three normal states of matter (solid, liquid, gas) in terms of energy, particle motion, and phase transitions.

2. Atomic Structure and Nuclear Chemistry

Broad Concept: Atomic models are used to explain atoms and help us understand the interaction of elements and compounds observed on a macroscopic scale. Nuclear chemistry deals with radioactivity, nuclear processes, and nuclear properties. Nuclear reactions produce tremendous amounts of energy and the formation of the elements.

2.1 Recognize discoveries from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus), and Bohr (planetary model of atom) and understand how these discoveries lead to the modern theory.
2.2 Describe Rutherford's "gold foil" experiment that led to the discovery of the nuclear atom. Identify the major components (protons, neutrons, and electrons) of the nuclear atom and explain how they interact.
2.3 Interpret and apply the laws of conservation of mass, constant composition (definite proportions), and multiple proportions.
2.4 Write the electron configurations for the first twenty elements of the periodic table.
2.5 Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power).
2.6 Describe the process of radioactive decay by using nuclear equations and explain the concept of half-life for an isotope, for example, C-14 is a powerful tool in determining the age of objects.
2.7 Compare and contrast nuclear fission and nuclear fusion.

3. Periodicity

Broad Concept: Repeating (periodic) patterns of physical and chemical properties occur among elements that define families with similar properties. The periodic table displays this repeating pattern, which is related to an atom's outermost electrons.

3.1 Explain the relationship of an element's position on the periodic table to its atomic number. Identify families (groups) and periods on the periodic table.
3.2 Use the periodic table to identify the three classes of elements: metals, nonmetals, and metalloids.
3.3 Relate the position of an element on the periodic table to its electron configuration and compare its reactivity with other elements in the table.
3.4 Identify trends on the periodic table (ionization energy, electronegativity, and relative size of atoms and ions).

4. Chemical Bonding

Broad Concept: Atoms bond with each other by transferring or sharing valence electrons to form compounds.

4.1 Explain how atoms combine to form compounds through both ionic and covalent bonding. Predict chemical formulas based on the number of valence electrons.
4.2 Draw Lewis dot structures for simple molecules and ionic compounds.
4.3 Use electronegativity to explain the difference between polar and nonpolar covalent bonds.
4.4 Use valence-shell electron-pair repulsion theory (VSEPR) to predict the electron geometry (linear, trigonal planar, and tetrahedral) of simple molecules.
4.5 Identify how hydrogen bonding in water affects a variety of physical, chemical, and biological phenomena (such as, surface tension, capillary action, density, and boiling point).
4.6 Name and write the chemical formulas for simple ionic and molecular compounds, including those that contain the polyatomic ions: ammonium, carbonate, hydroxide, nitrate, phosphate, and sulfate.

5. Chemical Reactions and Stoichiometry

Broad Concept: In a chemical reaction, one or more reactants are transformed into one or more new products. Chemical equations represent the reaction and must be balanced. The conservation of atoms in a chemical reaction leads to the ability to calculate the amount of products formed and reactants used (stoichiometry).

5.1 Balance chemical equations by applying the laws of conservation of mass and constant composition (definite proportions).
5.2 Classify chemical reactions as synthesis (combination), decomposition, single displacement, double displacement, and combustion.
5.3 Use the mole concept to determine the number of particles and the molar mass of elements and compounds.
5.4 Determine percent compositions, empirical formulas, and molecular formulas.
5.5 Calculate the mass-to-mass stoichiometry for a chemical reaction.
5.6 Calculate percent yield in a chemical reaction.

6. States of Matter, Kinetic Molecular Theory, and Thermochemistry

Broad Concept: Gas particles move independently of each other and are far apart. Their behavior can be modeled by the kinetic molecular theory. In liquids and solids, unlike gases, the particles are close to each other. The driving forces of chemical reactions are energy and entropy. The reorganization of atoms in chemical reactions results in the release or absorption of heat energy.

6.1 Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and the number of particles in a gas sample (Avogadro's hypothesis). Use the combined gas law to determine changes in pressure, volume, and temperature.

6.2 Perform calculations using the ideal gas law. Understand the molar volume at 273K and 1 atmosphere (STP).

6.3 Using the kinetic molecular theory, describe and contrast the properties of gases, liquids, and solids. Explain, at the molecular level, the behavior of matter as it undergoes phase transitions.

6.4 Describe the law of conservation of energy. Explain the difference between an endothermic process and an exothermic process.

6.5 Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy).

7. Solutions, Rates of Reaction, and Equilibrium

Broad Concept: Solids, liquids, and gases dissolve to form solutions. Rates of reaction and chemical equilibrium are dynamic processes that are significant in many systems (biological, ecological, and geological).

7.1 Describe the process by which solutes dissolve in solvents.

7.2 Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry.

7.3 Identify and explain the factors that affect the rate of dissolving, such as, temperature, concentration, surface area, pressure, and mixing.

7.4 Compare and contrast qualitatively the properties of solutions and pure solvents (colligative properties such as boiling point and freezing point).

7.5 Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, and catalyst).

7.6 Predict the shift in equilibrium when the system is subjected to a stress (LeChatelier's principle) and identify the factors that can cause a shift in equilibrium (concentration, pressure, volume, temperature).

8. Acids and Bases and Oxidation-Reduction Reactions

Broad Concept: Acids and bases are important in numerous chemical processes that occur around us, from industrial procedures to biological ones, from the laboratory to the environment. Oxidation-reduction reactions occur when one substance transfers electrons to another substance and constitutes a major class of chemical reactions.

8.1 Define the Arrhenius theory of acids and bases in terms of the presence of hydronium and hydroxide ions in water and the Bronsted-Lowry theory of acids and bases in terms of proton donor and acceptor.

8.2 Relate hydrogen ion concentrations to the pH scale, and to acidic, basic, and neutral solutions. Compare and contrast the strength of various common acids and bases such as vinegar, baking soda, soap, and citrus juice.

8.3 Explain how a buffer works.

8.4 Describe oxidation and reduction reactions and give some every day examples, such as, fuel burning, corrosion. Assign oxidation numbers in a reaction.

II. Scientific Inquiry Skills Standards

Scientific literacy can be achieved by supporting students to inquire about chemical phenomena. Engaging students in scientific inquiry allows them to develop conceptual understandings and scientific skills that are necessary to be informed decision-makers. The science curriculum should include substantial hands-on laboratory and field experiences, as appropriate, for students to develop and use these skills in a Chemistry course.

SIS1. Make observations, raise questions, and formulate hypotheses.
Students will be able to:
- ❑ Observe the world around them from a scientific perspective.
- ❑ Pose questions and form hypotheses based on personal observations, scientific articles, experiments, and knowledge.
- ❑ Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories.

SIS2. Design and conduct scientific investigations.
Students will be able to:
- ❑ Articulate and explain the major concepts being investigated and the purpose of an investigation.
- ❑ Select required materials, equipment, and conditions for conducting an experiment.
- ❑ Identify independent and dependent variables.
- ❑ Write procedures that are clear and replicable.
- ❑ Employ appropriate methods for accurately and consistently
    - o making observations;
    - o making and recording measurements at an appropriate level of precision and;
    - o collecting data or evidence in an organized way.
- ❑ Properly use instruments, equipment, and materials (such as scales, probeware, meter sticks, microscopes, computers, etc.) including: set-up, calibration (if required), technique, maintenance, and storage.
- ❑ Follow safety guidelines.

SIS3. Analyze and interpret results of scientific investigations.
Students will be able to:
- ❑ Present relationships between variables in appropriate forms.
    - o Represent data and relationships between variables in charts and graphs.
    - o Use appropriate technology (such as graphing software, etc.) and other tools.
- ❑ Use mathematical operations to analyze and interpret data results.
- ❑ Identify reasons for inconsistent results, such as sources of error or uncontrolled conditions, and assess the reliability of data.
- ❑ Use results of an experiment to develop a conclusion to an investigation that addresses the initial questions and supports or refutes the stated hypothesis.
- ❑ State questions raised by an experiment that may require further investigation.

SIS4. Communicate and apply the results of scientific investigations.
Students will be able to:
- ❑ Develop descriptions and explanations of scientific concepts that an investigation focused on.
- ❑ Review information, explain statistical analysis, and summarize data collected and analyzed from an investigation.
- ❑ Explain diagrams and charts that represent relationships of variables.
- ❑ Construct a reasoned argument and respond appropriately to critical comments and questions.
- ❑ Use language and vocabulary appropriately, speak clearly and logically, and use appropriate technology (such as presentation software, etc.) and other tools to present findings.
- ❑ Use and refine scientific models that simulate physical processes or phenomena.

III. Mathematical Skills

Students are expected to know the content of the *Massachusetts Mathematics Curriculum Framework, November 2000* through Grade 8. Below are some specific skills from the *Mathematics Framework* that students in this course should have the opportunity to apply:

- ✓ Construct and use tables and graphs to interpret data sets.
- ✓ Solve simple algebraic expressions.
- ✓ Perform basic statistical procedures to analyze the center and spread of data.
- ✓ Measure with accuracy and precision (length, volume, mass, temperature, time, etc.)

- ✓ Convert within a unit (such as, centimeters to meters).
- ✓ Use common prefixes such as milli-, centi-, and kilo-.
- ✓ Use scientific notation, where appropriate.
- ✓ Use ratio and proportion in the solution of problems.

The following skills are not detailed in the *Mathematics Framework*, but are necessary for a solid understanding in this course:

- ✓ Determine the correct number of significant figures.
- ✓ Determine percent error from experimental and accepted values.
- ✓ Use appropriate metric/standard international (SI) units of measurement for mass (kg); length (m); and time (s).
- ✓ Use Celsius and Kelvin scales.

These objectives support the following **Academic Expectations from the Masconomet High School Mission Statement**:

1. Students will communicate effectively.
2. Students will use problem solving skills.
3. Students will use a variety of technological and informational resources to gather, analyze, and synthesize facts, results, ideas and concepts.
4. Students will participate in decision making and team building activities
5. Students will demonstrate and practice an understanding of the rights and responsibilities of citizenship.

Materials and Activities:

CHAPTER 1. INTRODUCTION: MATTER AND MEASUREMENT

TOPIC	READING	LABS	DEMOS / PROJECTS
Lab Safety and Lab Equipment	Lab Safety and Lab Equipment Handouts	Identification of Common Lab Equipment	Safety Demos - Sulfuric Acid and Sucrose, Hot metal and glass
Lab Techniques, Units of Measurement and Uncertainty in Measurement	Expt. 1 and Sections 1.1, 1.4 and 1.5	Experiment 1: Basic Laboratory Techniques	-/-
Classifications of Matter: Pure Substances and Mixtures	Section 1.2	Experiment 2: Separation of the Components of a Mixture	States of Matter
Physical Properties of Matter	Section 1.3	Experiment 3: Identification of Substances by Physical Properties	Density of Crystalline Substance
Chemical Properties of Matter	Section 1.3	Experiment 4: Physical and Chemical Changes	-/-
Dimensional Analysis	Section 1.6	-/-	-/-

- Problem Set 1
- Test 1

CHAPTER 2. ATOMS, MOLECULES AND IONS

TOPIC	READING	LABS	DEMOS / PROJECTS
Atomic Theory of Matter	Section 2.1	Experiment 5: Law of Definite Proportions (MgO)	Electrostatic Attraction
Discovery of Atomic Structure	Section 2.2	-/-	Cathode Ray Tube, Radioactivity and Rutherford's Expt
Modern View of Atomic Structure	Section 2.3	-/-	Properties of Subatomic Particles
Periodic Table and the Properties of Elements	Section 2.4	Experiment 6: Properties of Metals and Nonmetals	-/-
Properties of Molecular and Ionic Compounds	Sections 2.5 - 2.6	-/-	Properties of Elements and Ionic Compounds
Naming Compounds	Section 2.7	-/-	Identification of Compounds Game

- Problem Set 2
- Test 2

CHAPTER 3. STOICHIOMETRY: CALCULATIONS WITH CHEMICAL FORMULAS AND EQUATIONS

TOPIC	READING	LABS	DEMOS / PROJECTS
Chemical Equations and Patterns of Chemical Reactivity	Sections 3.1 - 3.2	Experiment 7: Measuring Number of Particles in Samples of M&M's, Sprinkles and Silver Balls	Combustion, Combination and Decomposition Reactions: Methane Bubbles, Decomposition of Hydrogen Peroxide, Combustion of Wax
Atomic and Molecular Mass and The Mole	Sections 3.3 - 3.4	Experiment 7: Mass of One Mole of M&M's	Mass Spectrometer
Empirical Formulas From Chemical Analysis	Section 3.5	Experiment 8: Chemical Formula of a Hydrated Salt	Combustion Analysis to Determine Empirical Formulas and Molecular Formulas
Quantitative Information From Balanced Equations	Section 3.6	Experiment 9: Reaction of Zn and HCl	Reaction of Copper and Sulfur to form CuS
Limiting Reactants and Theoretical Yield	Section 3.7	-/-	Reactions of Zinc and Equal Volumes of 0.1M, 1M, 2M, 3M and 6M HCl

- Problem Set 3
- Test 3

CHAPTER 4: AQUEOUS REACTIONS AND SOLUTION STOICHIOMETRY

TOPIC	READING	LABS	DEMOS / PROJECTS
General Properties of Aqueous Solutions	Section 4.1	Experiment 10: Properties of Molecular and Ionic Compounds in Aqueous Solution	-/-
Metathesis Reactions	Section 4.2	Experiment 11: Reactions in Aqueous Solution (Metathesis Reactions)	-/-
Quantitative Analysis of a Precipitation Reaction	Section 4.2	Experiment 12: Analysis of Water Samples for Metal Ions and Non Metal Ions	Use of Filtration and Centrifuge
Chemical Formulas and Properties of Acids and Bases	Section 4.3	-/-	Properties of Acids/Bases and Use of Indicators
Concentration of Solutions	Section 4.5	Experiment 13: Making Solutions of HCl and NaOH	Proper Method of Making Solutions
Acid-Base Reactions and Solution Stoichiometry	Section 4.6	Experiment 14: Titration of Acids and Bases	Proper Method of Titration
Oxidation-Reduction Reactions	Section 4.4	Experiment 15: Analysis of the Reaction Between Copper Metal and Silver Ions in Solution	Examples of Redox Reactions

- Problem Set 4
- Test 4

CHAPTER 5: THERMOCHEMISTRY

TOPIC	READING	LABS	DEMOS / PROJECTS
The Nature of Energy and the First Law of Thermodynamics	Sections 5.1 - 5.2	-/-	Kinetic and Potential Energy
Enthalpy and Calorimetry	Sections 5.3 - 5.5	Experiment 16: Heat of Neutralization	Methane Cannon and Specific Heat of Air vs. Water Demo
Hess's Law	Section 5.6	Experiment 17: Hess's Law	-/-
Enthalpy of Formation	Section 5.7	-/-	Thermite
Foods and Fuels	Section 5.8	-/-	Comparison of Fuels: Propane, Octane, Methanol and Paraffin

- Problem Set 5
- Test 5

CHAPTER 6: ELECTRONIC STRUCTURE OF ATOMS

TOPIC	READING	LABS	DEMOS / PROJECTS
Wave Nature of Light, Quantized Energy and Photons	Sections 6.1 - 6.2	Experiment 18: Atomic Spectra: Flame Test	Properties of Waves, Electromagnetic Spectrum, Photoelectric Effect
Bohr's Model of the Hydrogen Atom	Section 6.3	Experiment 18: Atomic Spectra: Hydrogen Emission Spectra	-/-
Quantum Mechanics and Atomic Orbitals	Sections 6.4 - 6.5	-/-	-/-
Electron Configurations	Sections 6.6 - 6.9	Experiment 19: Reactivity of Metals and Nonmetals	-/-

- Problem Set 6
- Test 6

CHAPTER 7: PERIODIC PROPERTIES OF THE ELEMENTS

TOPIC	READING	LABS	DEMOS / PROJECTS
The Periodic Table and Atomic Size	Sections 7.1 - 7.2	Experiment 20: Properties of Metal and Nonmetal Oxides	Properties of Metals and Nonmetals
Ionization Energy and Electron Affinity	Sections 7.3 - 7.4	-/-	-/-
Group Trends	Sections 7.5 - 7.7	Experiment 21: Qualitative Analysis	-/-

- Problem Set 7
- Test 7

CHAPTER 8: BASICS CONCEPTS OF CHEMICAL BONDING

TOPIC	READING	LABS	DEMOS / PROJECTS
Chemical Bonds, Lewis Symbols and Octet Rule	Section 8.1	-/-	-/-
Ionic Bonds	Sections 8.2 - 8.3	-/-	-/-
Covalent Bonding, Bond Polarity, Electronegativity	Sections 8.4 - 8.5	-/-	-/-
Lewis Structures, Resonance Structures and Exceptions to Octet Rule	Sections 8.6 - 8.8	Experiment 22: Molecular Models Lab	-/-

- Problem Set 8&9

CHAPTER 9: MOLECULAR GEOMETRY AND VSEPR

TOPIC	READING	LABS	DEMOS / PROJECTS
Molecular Shapes and VSEPR	Sections 9.1 - 9.2	Experiment 22: Molecular Models Lab (continued)	-/-
Polarity of Molecules	Section 9.3	Experiment 23: Properties of Molecular and Ionic Compounds	Polarity of Water and Hexane

- Problem Set 8&9
- Test 8&9
- Midterm Lab - Analysis of Eleven Household Substances

CHAPTER 10: GASES

TOPIC	READING	LABS	DEMOS / PROJECTS
Characteristics of Gases, Kinetic Molecular Theory and Temperature	Sections 10.1 and 10.7	Experiment 24: Atmospheric Gases Lab	Molecular Motion
Pressure and Methods of Measuring Pressure	Section 10.2	-/-	Barometer and Manometer
The Gas Laws	Section 10.3	Experiment 25: Production of Hydrogen by Reaction of Mg and HCl	Coke Can, Balloon in Flask, CO_2 Cannon
Ideal Gas Law and Stoichiometry	Section 10.4	Experiment 26: Baking Soda and HCl Rxn	Molar Mass of Butane
Molar Mass and Density of Gases	Section 10.5	-/-	Methane Bubbles
Gas Mixtures and Partial Pressures	Section 10.6	Experiment 27: Rocket Lab	-/-

- Problem Set 10
- Test 10

CHAPTER 11: INTERMOLECULAR FORCES, LIQUIDS AND SOLIDS

TOPIC	READING	LABS	DEMOS / PROJECTS
Molecular Comparison of Liquids and Solids	Section 11.1	-/-	Viscosity of Liquids
Intermolecular Forces	Section 11.2	Experiment 28: Intermolecular Forces Lab	Ammonia Fountain
Separation Techniques: Chromatography, Distillation, etc.	-/-	Experiment 29: Paper and Column Chromatography	Distillation of Ethylene Glycol and Water
Properties of Liquids	Section 11.3	Experiment 30: Properties of Slime	-/-
Phase Changes, Vapor Pressure and Phase Diagram	Sections 11.4 - 11.6	Experiment 31: Phases Changes of PDCB	Boiling Point of Water with Changing Atmospheric Pressure

Properties of Solids	Section 11.8	-/-	Physical Properties of Solids

- Problem Set 11
- Test 11

CHAPTER 12: MODERN MATERIALS

TOPIC	READING	LABS	DEMOS / PROJECTS
Polymers	Section 12.2	Experiment 32: Recyclable Plastics	Ping Pong Balls

- Problem Set 12

CHAPTER 13: PROPERTIES OF SOLUTIONS

TOPIC	READING	LABS	DEMOS / PROJECTS
The Solution Process and Factors Effecting Solubility	Sections 13.1 - 13.3	Experiment 33: Determining the Solubility of an Unknown Salt	Solubility of Gases with Changing Temperature
Ways of Expressing Concentration	Section 13.4	-/-	Methods of Changing Experiment 34 to Determine Various Units of Concentration

- Problem Set 13
- Test 12 and 13

CHAPTER 14: CHEMICAL KINETICS

TOPIC	READING	LABS	DEMOS / PROJECTS
Reaction Rate	Section 14.1	-/-	Light Stick Demo
Effect of Concentration and Temperature on Rate of Reaction	Sections 14.2 - 14.4	Experiment 34: Iodine Clock Reaction	-/-
Determining a Rate Law for a Reaction	Sections 14.2 - 14.3	-/-	-/-
Reaction Mechanisms	Section 14.5	Experiment 35: Rate and Order of Hydrogen Peroxide Decomposition	-/-
Catalysis	Section 14.6	-/-	Hydrogen Peroxide Catalysts

- Problem Set 14
- Test 14

CHAPTER 15: CHEMICAL EQUILIBRIUM

TOPIC	READING	LABS	DEMOS / PROJECTS
Equilibrium Reactions and Equilibrium Constant	Section 15.1 - 15.2	Experiment 36: Qualitative Equilibrium: FeSCN	-/-
Heterogeneous Equilibria and Calculating Equilibrium Constants	Section 15.2	-/-	NO_2 Tubes
Calculating Equilibrium Concentrations	Section 15.5	-/-	-/-
Le Chatelier's Principle	Section 15.6	Experiment 37: Le Chatelier's Principle	-/-

- Problem Set 15
- Test 15

CHAPTER 16: ACID - BASE EQUILIBRIA

TOPIC	READING	LABS	DEMOS / PROJECTS
Properties of Acids and Bases	Sections 16.1 - 16.2	Experiment 38: Properties of Acids and Bases	-/-
Autoionzation of Water	Section 16.3	-/-	-/-
Measuring pH using pH paper, Indicators and pH meter	Section 16.4	-/-	Four Indicators in Buffers with pH 0-14
Strong Acids/Bases and Weak Acids/Bases	Sections 16.5 - 16.6	-/-	-/-
Acid and Base Ionization Constants	Section 16.8	-/-	-/-
Acid-Base Properties of Salt Solutions - Hydrolysis	Section 16.9	Experiment 39: pH of Salt Solutions	-/-
Acid-Base Behavior and Chemical Structure	Section 16.10	-/-	-/-

- Problem Set 16
- Test 16

CHAPTER 17: AQUEOUS EQUILIBRIA

TOPIC	READING	LABS	DEMOS / PROJECTS
The Common-Ion Effect	Section 17.1	-/-	Acetic Acid/Sodium Acetate Solution
Buffer Solutions	Section 17.2	Experiment 40: Preparation and Testing of a Buffer Solution	Carbonate Buffer
Acid-Base Titrations	Section 17.3	Experiment 41: Titration of a Diprotic Acid and Determination of the Ka's	-/-

- Problem Set 17
- Test 17

CHAPTER 19: CHEMICAL THERMODYNAMICS

TOPIC	READING	LABS	DEMOS / PROJECTS
Spontaneous Processes and Entropy	Sections 19.1 - 19.4	Experiment 42: Thermodynamics of the Solution Process	-/-
Gibbs Free Energy	Section 19.5	-/-	-/-
Free Energy and Temperature	Section 19.6	-/-	-/-
Free Energy and the Equilibrium Constant	Section 19.7	-/-	-/-

- Problem Set 19
- Test 19

CHAPTER 20: ELECTROCHEMISTRY

TOPIC	READING	LABS	DEMOS / PROJECTS
Oxidation-Reduction Reactions	Sections 20.1 - 20.2	-/-	-/-
Voltaic Cells, Cell EMF	Section 20.3 - 20.4	Experiment 43: Determination of Electrochemical Series	Electrode Fruits
Spontaneity of Redox Rxns and Effect of Concentration on Cell EMF	Sections 20.5 - 20.6	-/-	-/-
Batteries	Section 20.7	Experiment 44: Making a Battery	-/-
Corrosion, Metal Plating and Electrolysis	Sections 20.8 - 20.9	-/-	Corrosion of Iron, Plating Copper and Electrolysis of Water

- Problem Set 20
- Test 20

CHAPTER 18: CHEMISTRY OF THE ENVIRONMENT

TOPIC	READING	LABS	DEMOS / PROJECTS
Earth's Atmosphere	Sections 18.1 - 18.2	Experiment: Determination of % of Oxygen in Fresh and Exhaled Air	-/-
Ozone in the Upper Atmosphere	Section 18.3	Experiment: Atmospheric Pollutants	-/-
Chemistry of the Troposphere	Section 18.4	-/-	-/-
The World Ocean	Section 18.5	Experiment: Seawater Analysis	-/-
Freshwater	Section 18.6	Experiment: Freshwater Analysis	-/-

- Problem Set 18
- Test 18
- Final Exam

Assessment:
Successful completion of the course requires that each student completes thirty-five wet chemistry laboratory experiments, seventeen problem sets based on the chapters covered in the textbook, and sixteen chapter exams.